

General Motor Knowledge
Part 31

Motor/Fan Performance

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Last month we established the speed-torque curve for a motor. Speed starts at 0 RPM in the lower left corner and increases up the page. Torque starts at 0, at the same place on the page as speed. Torque increases to the right across the page. The moment power is applied to the motor, RPM is still 0, while the motor develops some torque to start the rotor turning. This accelerates the rotor and speed increases. Torque and speed continue to increase with speed until torque reaches some maximum value. From this point, torque decreases as the rotor begins to revolve at the same speed as the magnetic field producing it.

A fan blade requires torque in an amount proportional to the square of the speed. The speed-torque requirements for three fan blades are shown drawn on top of the motor speed-torque curve. The motor fan combination will operate where these curves intersect. Here the motor speed-torque fulfills the speed and torque requirement of the fan blade. A light fan requires very little from the motor. It operates at or near the motor maximum speed and does not utilize the motor's maximum power output. A heavy fan may not allow the motor to develop its full potential or come up to speed. The medium fan is the better choice.

Think of the fan blade petal as a shovel. A child can move dirt with a small spade. An adult may take the same spade and dig faster but not move very much more dirt than did the child. Give the adult a shovel and scoop for scoop more dirt will be moved than with the small spade. If the shovel is so large that the adult must dig slowly, resting between scoops, it is again likely that not much dirt will be moved. It is also likely that the adult will overheat and quit.

The motor and fan blade should be matched for best efficiency. This is easily done by overlaying the speed-torque curves of the motor and fan blade.

